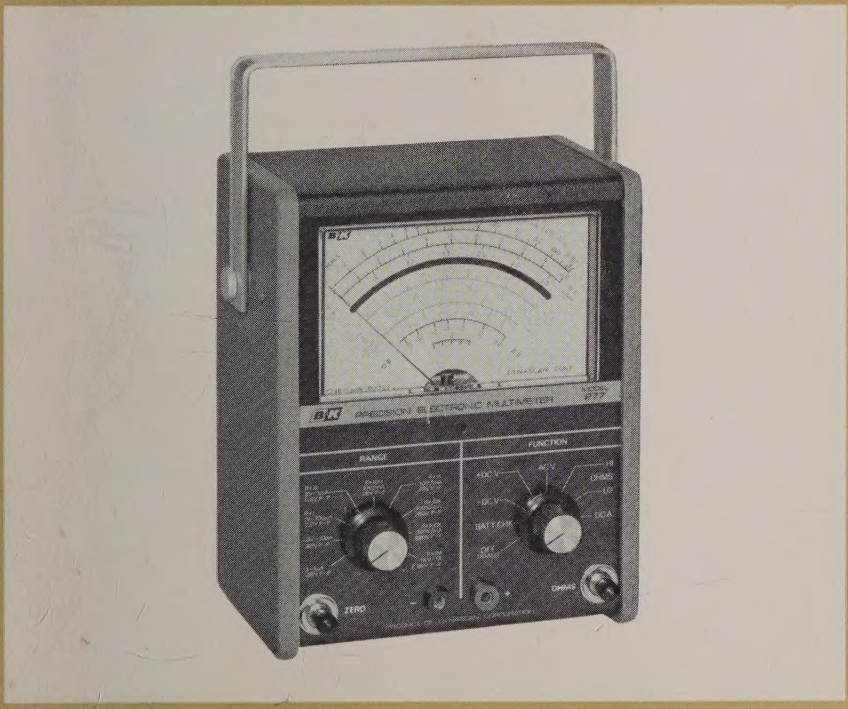
INSTRUCTION MANUAL

B+K PRECISION 277

SOLID STATE ELECTRONIC MULTIMETER



B+K PRECISION DYNASCAN CORPORATION

Dear Friend:

Congratulations on your purchase of B & K-Precision Test Equipment, and welcome to the B & K-Precision family. We hope your experience with your new test equipment will make you a lifetime B & K-Precision customer.

Your instrument is backed by more than 20 years of experience in designing and manufacturing. Our most important goal is your satisfaction. At B & K-Precision, test equipment is made to meet the demands of the field, focusing on dependability and accuracy. We also concentrate on simplicity and operating ease with features that reduce the possibility of human error and speed the servicing process.

In order to determine the type of test units that are needed we have been guided by letters and reports from technicians and engineers who use the equipment daily. Our field tests and studies have helped provide better and faster service techniques.

B & K-Precision product designs are constantly reviewed, and refinements are made or new models developed to meet advances in our industry and to fill your needs. We set our standards high so you can be assured that B & K-Precision test instruments you buy represent advanced design, quality construction, and dependable long-term performance at a price you can afford.

If you have any comments or thoughts about our products, or test equipment in general, I would be delighted to hear from you.

Thanks for your confidence in B & K-Precision and we look forward to serving you for a long time to come.

Sincerely,

Carl Korn
President

INSTRUCTION MANUAL

FOR

Model 277

SOLID STATE ELECTRONIC MULTIMETER

B+K PRECISION DYNASCAN CORPORATION

6460 West Cortland Street
Chicago, Illinois 60635

TABLE OF CONTENTS

	Page
GENERAL DESCRIPTION AND SPECIAL FEATURES	5
SPECIFICATIONS	5
OPERATING CONTROLS	7
OPERATING THE MODEL 277	8
SAFETY PRECAUTIONS	8
MAINTENANCE	14
CIRCUIT DESCRIPTION	16

GENERAL DESCRIPTION AND SPECIAL FEATURES

The B & K Model 277 is a solid state FET input Electronic Multimeter ideally suited for radio and TV service technicians, industrial users, engineers and hobbyists.

Its main features include:

- High input Impedance on both a-c and d-c voltage measurements for minimum circuit loading.
- Low voltage and normal voltage ohms tests for measuring resistances or for testing IC's, transistors, SCR's, etc. in or out-of-circuit.
- Low power drain (less than 2ma) for extended battery life, including a battery check test.
- Protection from accidental overloads to meter, FET's and other circuit elements.
- An adjustable handle; a nice feature for bench use.
- A mirrored scale meter which increases accuracy of measurements.

SPECIFICATIONS

DC VOLTS:	
9 Ranges:	.1, .3, 1, 3, 10, 30, 100, 300, 1000V full scale.
Accuracy:	±2% full scale.
Input Resistance:	15 Megohms, ±2%, including 100K isolating resistor in probe.
AC Rejection:	20db minimum @ 60Hz for 2% accuracy change.
AC VOLTS:	
9 RMS Ranges:	.1, .3, 1, 3, 10, 30, 100, 300, 1000V full scale.
9 Peak-to-Peak Ranges:	.28, .88, 2.8, 8.8, 28, 88, 280, 880, 2800V full scale.
Accuracy:	±3% full scale @ 60Hz.
Input Impedance:	10 megohms shunted by approximately 56pf at input jacks.
Frequency Response:	±.5db, 20Hz to 140KHz. Approx. 3db @ 400KHz.
OHMS MEASUREMENT:	
7 Low Voltage Ranges (68mv):	RX1, RX10, RX100, RX1K, RX10K, RX100K, RX1M.
7 Normal Voltage Ranges (1.5V):	RX1, RX10, RX100, RX1K, RX10K, RX100K, RX1M.
Midscale Reading:	10 ohms on RX1 Range.
Accuracy:	±3° of arc.

DC CURRENT:	
9 Ranges:	1μa, 10μa, 100μa, 1ma, 10ma, 30ma, 100ma, 300ma, 1 amp full scale.
Accuracy:	$\pm$3% full scale.
Internal Voltage Drop:	At instrument input terminals— 100mv, all ranges. Thru input cable— 100mv on 1μa to 30ma ranges. 140mv to 203mv on 100ma to 1 Amp range.
DECIBEL (db):	
9 Ranges:	-20 to $+62$.
Accuracy:	$\pm$3% of full scale.
Reference:	1mw into 600 ohms. (.775v)
MULTIPLIER AND SHUNT RESISTORS:	
1% Precision Type:	Frequency Compensated.
METER:	4½", 50μa, $\pm$2%. DC zero center ranges. Mirrored scale meter.
PROTECTION:	Meter and FET input protected from overloads. Circuit overload protection by fuse (.75 Amp), except 1 Amp range.
SEMICONDUCTORS:	(1) Dual N-Channel FET. (3) NPN Transistors. (3) Germanium Diodes. (6) Silicon Diode, I Amp, 600 PIV.
BATTERIES REQUIRED: (Not Supplied)	(1) NEDA 1604 (9 Volt). (1) #950 "D" Cell (1½ Volt).
DIMENSIONS:	7¼" H. x 5$\frac{13}{16}$" W. x 3⅝" D.
WEIGHT:	2 lbs., 6 oz. (less batteries and probe assembly)

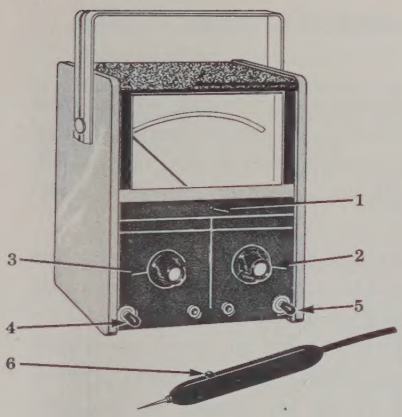


Figure 1. Operating Controls

OPERATING CONTROLS

The Model 277 Electronic Multimeter is as simple to operate as a standard VOM. The following is a brief description of each control and how it is used (Refer to Figure 1).

1. METER ZERO ADJUST (MECHANICAL): The mechanical zero adjustment must be made before the 277 is turned on. Insert a screwdriver (preferably non-metallic) into the slot located in the center of the front panel immediately below the meter face. While gently tapping meter, very slowly turn the mechanical zero-adjust counterclockwise until the pointer rests at zero.

2. FUNCTION SWITCH: The FUNCTION switch is used to turn the Model 277 on, to check the battery condition and to select the type of measurement to be performed. In the OFF position the meter is damped for protection in transit.

3. RANGE SWITCH: The RANGE switch selects the desired range of current, voltage, or resistance to be measured.

4. ZERO CONTROL: The ZERO control is used to position the pointer of the meter at zero on the meter scale or to position the pointer on the zero center when using this feature.

5. OHMS CONTROL: The OHMS control is adjusted with the test leads open. Rotate the OHMS control for a full scale indication, infinity (∞) on the ohms scale of the meter.

6. PROBE SWITCH: The Model 277 is equipped with a shielded test lead to allow accurate a-c measurements in the presence of strong electrical fields. When the switch is in the 100K position, a 100K resistor is switched in series with the test lead. This isolates the cable capacity from the circuit under test when making d-c voltage measurements in r-f, i-f or sweep circuits. Set the probe switch to the DIRECT position for all measurements other than d-c voltage.

OPERATING THE MODEL 277

SAFETY PRECAUTIONS

A certain amount of danger is always present when working on electrical equipment and therefore, the user is cautioned to always familiarize himself as much as possible with the equipment to be tested, before any work is performed. It should be kept in mind that high voltages often appear at unexpected points in defective equipment.

When testing high voltage circuits, develop the habit of keeping one hand in your pocket to minimize the hazard of accidental shock. It is also important to have a properly insulated floor or floor covering to stand on while taking measurements. Be particularly careful to avoid contacting nearby objects which could provide a ground return path. A good practice is to remove operating power before connecting test leads. An isolation transformer should always be used in equipment having the chassis tied to one side of the a-c power line.

BATTERY INSTALLATION

To install or gain access to the batteries, remove the battery compartment cover located on the rear cover of the 277. This is done by removing one (1) screw located at the top of the battery compartment cover. Tilt the cover gently outward and upward until it clears the main rear cover.

For models which do not have a separate battery compartment, remove the back from the 277. This is done simply by removing two (2) screws at the bottom and the two (2) screws at the rear near the top. After the screws have been removed, tilt the bottom part of the back outward (away from rear of unit) and then gently lift the back up and away from the top portion of the front panel.

After installing batteries, set FUNCTION switch to the BATT CHK position to check the 9 volt battery. Meter must indicate at or beyond BATT OK indication on meter scale. Set FUNCTION switch to HI OHMS and RANGE switch to the RX100K position. Rotate OHMS control to obtain an infinity (∞) indication on meter. Short test leads together and adjust zero control so meter reads zero. Unshort leads and check that the meter can be readjusted to infinity (∞) when rotating OHMS control. If batteries test satisfactorily, re-install back cover.

NOTE

To prolong battery life, always turn the unit OFF when not in use.

1. PREPARATION FOR MAKING MEASUREMENTS

a. With the FUNCTION switch in the OFF position, check to see that the meter pointer rests over the zero mark on the left side of the scale. If the

pointer is off zero, reset the meter zero adjust (mechanical) as explained under OPERATING CONTROLS.

b. Insert the double banana plug of the test lead assembly into the meter terminal receptacles so that the positive (+) pin of the plug is in the red (+) terminal of the meter.

c. Rotate the FUNCTION switch to the BATT CHK position, and observe the deflection of the meter pointer. As long as the pointer remains within the range of BATT OK indicated by red arrowhead on the upper part of the scale, the instrument accuracy is maintained.

2. MEASURING DC VOTAGES

a. Turn the FUNCTION switch to the −DC V or +DC V position, depending on the polarity of the voltage to be measured.

b. Set the PROBE switch to 100K.

c. When measuring an unknown voltage, set the RANGE switch fully clockwise.

d. Rotate ZERO control until meter pointer rests over zero mark on DC V/MA scale.

e. Connect the black (negative) lead of the test lead assembly to ground or reference point of the circuit under test. Bring the probe tip in contact with the point to be measured.

f. Observe the instrument reading; if the meter pointer deflects to the left, turn the FUNCTION switch to the correct polarity.

g. The d-c voltage is read on the two black scales just above the mirror on the meter. The top DC scale is used with the .1, 1, 10, 100, and 1,000 volt ranges. The second DC scale is used for the .3, 3, 30, and 300 volt ranges. The 0 to 1.0 volt scale is read directly for the 1.0 volt range, and is multiplied by .1, 10, 100, and 1,000 for the .1, 10, 100, and 1,000 volt ranges respectively. The 0 to 3.0 volt scale is read directly for the 3.0 volt range and multiplied by .1, 10, and 100 for the .3, 30 and 300 volt ranges respectively.

3. ZERO CENTER DC VOLTAGES

a. Set the FUNCTION switch at +DC V and short the test leads together.

b. Rotate the ZERO control knob clockwise until the meter pointer rests over the center zero mark (the bottom scale).

c. Set the RANGE selector switch to a range which is at least twice the probable voltage to be measured. Connect the test leads to the circuit the same as for d-c voltage measurement.

d. Observe the meter pointer indication on the black scale marked "0". Positive voltages will make the pointer deflect to the right of the center zero mark; negative voltages will make the pointer deflect to the left of the center zero mark. Each side of the scale represents one-half of the range being used.

For example, when the .1 volt range is being used, each half of the scale

represents .05 volt and each division .01 volt. The purpose for which the center zero scale is used is to indicate a balanced condition. For example, if the 277 is used in the alignment of an FM discriminator, the desired balanced condition will result in a reading of zero on the meter. A misaligned condition will cause some deflection in either the positive or negative direction.

4. MEASURING AC VOLTAGES (RMS & P-P)

NOTE

Effect of waveform in measuring AC voltages: The Model 277 employs a peak-to-peak type detector, and is calibrated using a sinusoidal signal. The scale is calibrated to give RMS readings, using effective values based on a true sine wave. When it is known that other than sinusoidal signals are being used, it must be recognized that the accuracy as specified for sinusoidal will not apply. However, peak-to-peak values will remain accurate.

a. Set the FUNCTION switch to AC V position.
b. Set the probe switch to DIRECT.
c. Set the RANGE switch to the desired range position. If the range is not known, set RANGE switch fully clockwise.
d. Short test leads together and rotate ZERO control until meter pointer rests over zero mark on AC V RMS scale.
e. Connect the black (negative) lead of the test lead assembly to the chassis or reference point of the circuit under test.
f. Bring the tip of the probe in contact with the point in the circuit where the voltage is to be measured.
g. Observe the meter indication. To measure RMS voltage, the two red scales marked AC V RMS are used. To measure peak-to-peak voltage, the two red scales marked AC V (P-P) are used. The scale readings are multiplied by the same multiplier factors as were used in d-c voltage measurements.

5. DB MEASUREMENTS

The dB scale (−20 dB to +2dB) for measuring output level is calibrated according to the standard of 1mW into 600 ohms, and direct scale reading applies with RANGE switch at 1V position. The nine AC V ranges are in 10dB steps, so that starting from "0dB" on the 1V range, add 10dB for each range above 1.0 volt and subtract 10 dB for each range below 1.0 volt. dB measurements are a measure of the ratio between the power in the circuit under test, and the standard reference level indicated above. If the impedance across which the measurement is performed is other than 600 ohms, use Figure 2 to determine actual power level with respect to 600 ohm reference. The chart in Figure 3 can be used to determine the power being dissipated in a circuit if the circuit impedance along

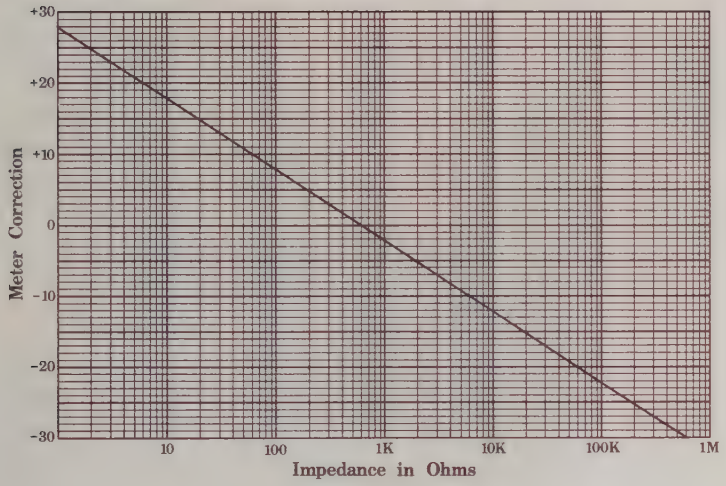


Figure 2. dB Correction Chart

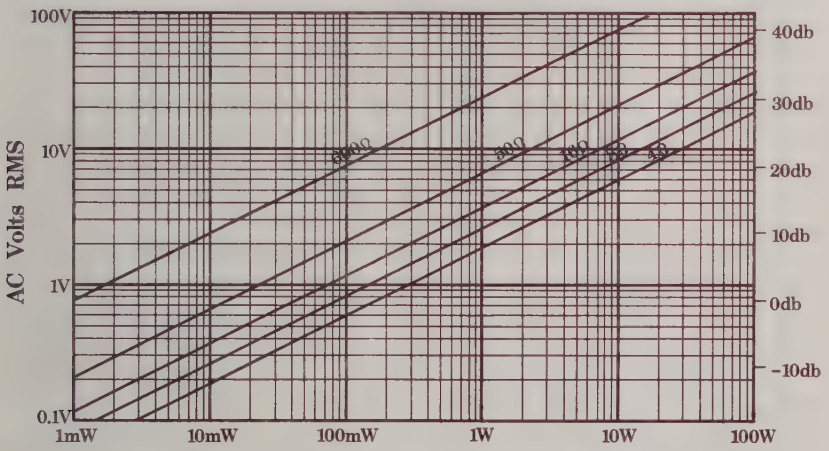


Figure 3. Voltage vs. Power Chart (Sine Wave Conditions Only)

with either the applied voltage, or the dB is known. This chart also shows the relationship of AC volts to dB.

NOTE

The dB scales of the 277 and the charts in Figure 2 and Figure 3 only apply when the voltage being measured is a pure sine wave. Complex waveforms such as those encountered in music material will not give a true RMS reading for the dB system to work on, but the dB scales can be used for relative level measurements.

6. MEASURING RESISTANCES

CAUTION

When making resistance measurements be sure that the power to the equipment under test is disconnected. If voltage is accidentally applied to the ohms range, fuse replacement may become necessary.

A. HI OHMS MEASUREMENTS: To measure resistance, set the FUNCTION switch to the HI OHMS position, and the RANGE switch to the range that will put the resistance to be measured as close to the center of the meter scale as possible. When you switch the FUNCTION switch to the OHMS functions, the meter pointer will move from the left hand edge of the meter (Zero) to the infinity (∞) mark on the right hand side of the meter. Rotate the OHMS control to adjust the meter pointer to exactly the infinity mark on the right hand side of the meter.

When the meter leads are shorted together, the meter will indicate zero ohms on the left hand side of the meter. Be sure that the probe switch is in the DIRECT position. A resistance reading of approximately one ohm will be present on the RX1 range. This is the resistance of the switch contacts, ohms battery and internal wiring and should be subtracted from the resistance being measured on this range only.

When using the HI OHMS function in solid state circuits, the applied 1.5 volts from the 277 will be high enough to cause diodes or transistors to conduct. By reversing the meter leads, the front to back ratio of transistors or diodes can be measured. On all resistance ranges, the probe tip is positive with respect to the minus (−) test lead. Remember this when checking components which have a forward and reverse resistance such as semiconductors and electrolytic capacitors.

B. CHECKING FOR TRIGGERING OF LOW POWER SILICON CONTROLLED RECTIFIERS (SCR): Low Power SCR's can be checked to see if they can be triggered to the ON condition. To make this check, proceed as follows:

(1) Set your 277 to the HI OHMS function and the RANGE switch to RX1.
(2) Adjust OHMS control so meter reads full scale (∞).
(3) Set Probe switch to DIRECT position.
(4) Connect Minus (−) test lead to the cathode of the SCR and the Plus (+) test lead to the anode.
(5) If the SCR is good, meter will continue to read ∞. Now momentarily short gate lead to anode lead. Meter should read a very low resistance indicating that the SCR has been triggered and is conducting. Removing voltage from anode lead of SCR will return it to the non-conducting condition.

C. LOW OHMS MEASUREMENTS: The LO OHMS function is used to make resistance measurements in solid state circuits when the forward conduction of a diode or transistor junction can cause an objectionable error. When using this function, only 68 millivolts (.068 volt) is applied to the circuit being measured. This is below the conduction threshold of silicon and germanium semiconductor junctions.

The resistances measured with the 277 in the LO OHMS function will only be the resistance of the circuit components connected to the transistor or diode, and will not be affected by semiconductor devices.

IC's can be checked to see if they are shorted and also to measure resistance values within the IC.

NOTE

There is a continuous drain of approximately 6.8ma from the ohms battery in the LO OHMS position. To conserve ohms battery power, DO NOT LEAVE THE 277 IN THE LO OHMS POSITION WHEN NOT MAKING RESISTANCE MEASUREMENTS.

D. MEASURING RESISTANCE OF THERMISTORS: The LO OHMS function should be used for making accurate measurements of resistances of thermistors of low resistance value. If this measurement is made in the HI OHMS function, a changing resistance reading will result due to heating caused by the higher current flow through the thermistor. The thermistor should not be held in the hand and should be kept away from any other heat to obtain the most accurate resistance indication.

7. MEASURING DC CURRENT:

a. Set the FUNCTION switch to DC A.

b. Set the Probe switch to DIRECT position.

c. Short test leads together and rotate ZERO control until pointer rests over zero mark on DC V/MA scale.

d. Set the RANGE switch to the range desired. If the approximate value of current flowing within the circuit is not known, turn the RANGE switch to the 300mA position and work down toward the 1μa range until an accurate reading is obtained.

e. Open the circuit in which you wish to measure current flow. Connect the ground lead of the test lead assembly to the negative side of the circuit. Connect the tip of the probe to the positive side of the circuit under test.

f. Turn the power on in the circuit under test. Observe the meter pointer deflection. If the pointer is deflected to the left the current polarity is opposite of that which was anticipated. Turn off power, reverse the test lead and turn the power on again.

NOTE

The 1μa thru 300ma ranges are protected by an internal fuse. Use caution when using the 1 Amp range, since it is not fuse protected.

MAINTENANCE

The only normal maintenance required by the 277 is replacement of the batteries. This is described earlier in the manual under BATTERY INSTALLATION. The calibration, bias and balance adjustments have been made carefully and accurately at the factory, and should not require readjustment unless components have been replaced or adjustments have been disturbed. If, for any reason, recalibration becomes necessary, carefully perform the following procedures as required.

CALIBRATION OF THE 277 (SEE FIGURE 4 FOR ADJUSTMENT LOCATIONS): To gain access to the calibration adjustments it will be necessary to remove the back from the 277 (See BATTERY INSTALLATION for back removal instructions). These adjustments must be made in the order as indicated below.

(1) BIAS ADJUSTMENT: Connect an external voltmeter between + meter terminal on 277 and common ground (foil ground, −jack, etc.). Set the ZERO control so meter pointer rests over zero mark on DC V/MA scale. Adjust Bias adjusmtent so that external meter reads 4.7 volts.

(2) BALANCE: The balance control is set so that with the front panel zero control fully clockwise and the FUNCTION switch in the DC V position, the meter will indicate between .55 and .65 on the 0 to 1 volt scale. To adjust the balance control, set the RANGE switch to the 1KV range, set the FUNCTION switch to either DC volts position and turn the front panel zero control fully clockwise. Adjust the balance control until the meter indicates .6 on the 0 to 1 volt scale.

(3) DC VOLTS CALIBRATION: First check the setting of the mechanical and electrical zero adjustments. Set the RANGE switch to the .1V range, and the FUNCTION switch to the + DC V position. Set the Probe switch to the 100K position. Apply exactly .1 volt d-c to the input terminals and adjust DC Cal Pot for exactly a 1.0 indication on the 0 to 1 DC V/MA scale.

(4) AC VOLTS CALIBRATION: First check the setting of the mechanical and electrical zero adjustments. Set the RANGE switch to the .1V position, and the FUNCTION switch to the AC V position. Set the Probe switch to DIRECT position. Short test leads together and zero meter. Apply exactly a .1 volt RMS sine wave (60Hz to 1KHz) to the input terminals, and adjust AC Cal pot for exactly a 1.0 indication on the meter 0 to 1 AC V RMS scale. Calibration accuracy is dependent on accuracy of calibrating source.

(5) DCA CALIBRATION: First check the setting of the mechanical and electrical zero adjustments. Set the RANGE switch to the 1μa range, and the FUNCTION switch to the DCA position. Set the

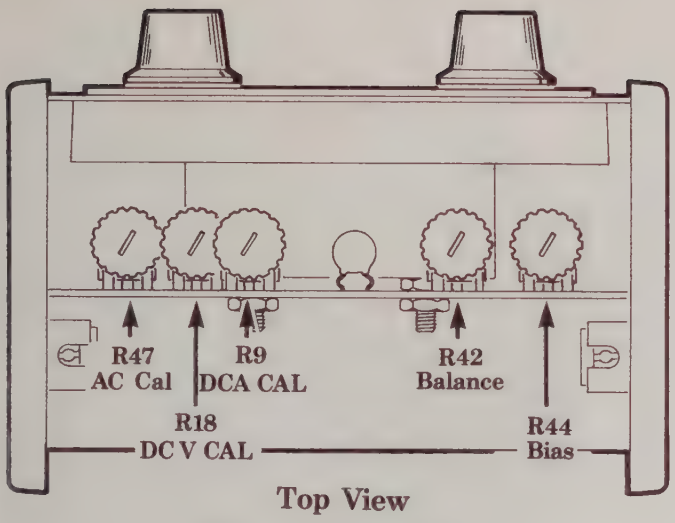


Figure 4. Adjustment Locations

probe switch to the DIRECT position. Apply exactly .1 volt d-c or 1μa to the input terminals and adjust DCA Cal Pot for exactly a 1.0 indication on the 0 to 1 DC V/MA scale.

REMOVING THE MODEL 277 FROM ITS CASE

To gain access to the printed circuit board and for general servicing, the case (end pieces) must be removed from the front panel.

To remove the case, first remove the back from the 277. See removal instructions under BATTERY INSTALLATION. Next, remove the two screws from the tie bar located at the top rear, just above the meter. Rotate the handle down toward the bottom rear of the 277. Gently pull end pieces outward (sideways) and away from front panel. Lift case (end pieces) up and away from front panel.

To remove the printed circuit board from the front panel, remove the two large control knobs and control nuts on the front panel. Sufficient lead length is provided to allow servicing of P.C. board.

The meter may be removed by taking out the meter mounting nuts that tie and connect the meter to the printed circuit board. Be sure to properly replace special contacting washers between PC Board and meter mounting nuts when reassembling.

OVERLOAD PROTECTION: The 277 is protected against accidental overloads on all functions and all ranges except the 1A range. The voltage ranges are protected because the high input impedance of the 277 limits the amount of voltage and current to the gate of the FET. On the resistance and current functions, the fuse F1 protects both the meter movement and the circuitry. This fuse should be replaced with one of the same type so that the protection feature or accuracy are not affected. Meter protection is provided by a silicon diode across its terminals. If the 277 is excessively overloaded it may take several minutes to completely stabilize.

CIRCUIT DESCRIPTION

The Model 277 Electronic Multimeter uses a balanced bridge impedance converter consisting of a dual field effect transistor and two (2) bi-polar transistors. This circuitry provides high input impedance and excellent stability.

When making d-c voltage measurements the d-c voltage is applied to the voltage divider (R27 through R34). The RANGE switch S28 selects the required input voltage to be applied to the input gate of Q2. The FET Q2 provides the necessary high input impedance, and drives the base of Q4.

Q3 and Q4 operate as a stable differential amplifier with the meter connected between the collectors. The base of Q4 is driven by Q2 for d-c volts, ohms, and for current measurements. The base of Q3 (the 2nd half of the differential pair) is driven by Q2 for a-c voltage measurements. This half of Q2 is in turn driven by the peak-to-peak detector, D3 and D4. In the d-c volts, and current functions, the peak-to-peak detector is shorted and does not receive a signal from Q2.

The dual FET is independent of temperature effects because it is in a small T0-71 package and very little temperature differential can exist between sections.

In the resistance measurement function, a standard resistor is placed in series with either a 68mv or 1.5 volt source and the voltage is applied to the gate of Q2. The meter will read up scale with this arrangement and the OHMS control allows adjustment at exactly full scale (∞). If the test leads are shorted together, the gate of Q2 will be shorted to ground and therefore receive no voltage. The meter then reads zero ohms. If a resistor between zero ohms and infinite resistance is placed between the test leads, the gate will receive a voltage proportional to the resistor ratios (internal standard and measured resistor) and the meter will indicate the resistance on the Ohms scale. If the resistance being measured is equal to the standard internal resistance of the 277, one half of the voltage will be applied to the gate and the meter will read half scale. Voltage for the HI OHMS function is obtained from the 1.5 volt battery and is divided down before application to the gate of Q2.

The 68 millivolts for the LO OHMS function is developed across a voltage divider R11, R15, and R16, and applied directly to the gate of Q2 thru a standard resistor. With more IC's and transistors being used everyday the LO OHMS function of the 277 is a must for making resistance measurements in solid state circuits.

When making a-c measurements the a-c rejection filter is switched out and AC is applied to the same divider as is used for d-c voltage measurements. However, capacitors across the divider now provide frequency compensation on all ranges. Therefore all frequencies between approximately 30Hz and 100KHz are attenuated equally in this divider when switching

ranges. The differential amplifier provides a-c gain and the peak-to-peak detector develops a negative voltage dependent on the peak positive and the negative voltage swing of the input voltage fed to it. The gate of Q2 receives the detected signal, applies it to Q3 which in turn drives the meter.

When measuring d-c current, a standard resistor is selected by the RANGE switch and put in series with the circuit to be measured. The voltage across the standard resistor is then measured and read as current on the meter. The fuse F1 protects resistors R16, R24, and R25. Fuse protection is not required on high resistance value resistors. The meter movement itself is protected on all ranges because it is isolated thru the impedance converter and shunted with a diode.

WARRANTY SERVICE INSTRUCTIONS

1. Refer to the MAINTENANCE section of your B & K-Precision instruction manual for adjustments that may be applicable.

2. If the above-mentioned procedures do not correct the problem you are experiencing with your unit, pack it securely (preferably in the original carton or double-packed). Enclose a letter describing the problem and include your name and address. Deliver to, or ship PREPAID (UPS preferred) to the nearest B & K-Precision authorized service agency (see list enclosed with unit).

If your list of authorized B & K-Precision service agencies has been misplaced, contact your local distributor for the name of your nearest service agency, or write to:

Service Department

B & K-Precision Product Group
DYNASCAN CORPORATION
2815 West Irving Park Road
Chicago, Illinois 60618

LIMITED ONE-YEAR WARRANTY

DYNASCAN CORPORATION warrants to the original purchaser that its B & K-PRECISION product, and the component parts thereof, will be free from defects in workmanship and materials for a period of one year from the date of purchase.

DYNASCAN will, without charge, repair or replace, at its option, defective product or component parts upon delivery to an authorized B & K-PRECISION service contractor or the factory service department, accompanied by proof of the date of purchase in the form of a sales receipt.

To obtain warranty coverage, this product must be registered by completing and mailing the enclosed warranty registration card to DYNASCAN, B & K-PRECISION, P.O. Box 35080, Chicago, Illinois 60635 within five (5 days) from the date of purchase.

Exclusions: This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alterations or repairs. It is void if the serial number is altered, defaced or removed.

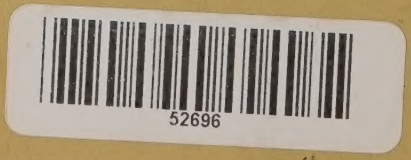
DYNASCAN shall not be liable for any consequential damages, including without limitation damages resulting from loss of use. Some states do not allow limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific rights and you may also have other rights which vary from state to state.

For your convenience we suggest you contact your B & K-PRECISION distributor, who may be authorized to make repairs or can refer you to the nearest service contractor. If warranty service cannot be obtained locally, please send the unit to B & K-PRECISION Service Department, 2815 West Irving Park Road, Chicago, Illinois 60618, properly packaged to avoid damage in shipment.

B+K PRECISION DYNASCAN CORPORATION

6460 West Cortland Street
Chicago, Illinois 60635



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